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CLAIMS

(57) [Claim(s)]

[Claim 1] It is NOX when the air-fuel ratio of the flowing exhaust gas is Lean. NOX absorbed when it absorbs and the oxygen density in the flowing exhaust gas was reduced NOX to emit. While arranging an absorbent in an engine flueway It is always NOX during engine operation. Exhaust gas is circulated to an absorbent. NOX It is NOX when the exhaust gas which flows into an absorbent is Lean. NOX absorbed by the absorbent NOX It is NOX when the oxygen density in the exhaust gas which flows into an absorbent is made to fall. In an internal combustion engine's exhaust emission control device it was made to emit from an absorbent Said NOX A liquid reducing agent is supplied to an absorbent and it is NOX. It is NOX by making the oxygen density in the exhaust gas which flows into an absorbent fall. NOX absorbed by the absorbent NOX While making it emit from an absorbent Said NOX Exhaust emission control device of the internal combustion engine characterized by establishing a reducing-agent preheating means to heat beforehand the liquid reducing agent supplied to an absorbent.

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(54)【発明の名称】 内燃機関の排気浄化装置

(57)【特許請求の範囲】

【請求項1】流入する排気ガスの空燃比がリーンであるときにNO_xを吸収し、流入する排気ガス中の酸素濃度を低下させると吸収したNO_xを放出するNO_x吸収剤を機関排気通路内に配置すると共に、機関運転中常時NO_x吸収剤に排気ガスを流通させておき、NO_x吸収剤に流入する排気ガスがリーンのときにNO_x吸収剤に吸収されたNO_xをNO_x吸収剤に流入する排気ガス中の酸素濃度が低下せしめられたときにNO_x吸収剤から放出するようにした内燃機関の排気浄化装置において、前記NO_x吸収剤に液体還元剤を供給してNO_x吸収剤に流入する排気ガス中の酸素濃度を低下せしめることによりNO_x吸収剤に吸収されているNO_xをNO_x吸収剤から放出すると共に、前記NO_x吸収剤に供給する液体還元剤を予熱する還元剤予熱手段を設けたことを特

徴とする内燃機関の排気浄化装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、内燃機関の排気浄化装置に関し、詳細には、ディーゼルエンジンや希薄燃焼を行うガソリンエンジン等、大部分の運転領域においてリーン空燃比の燃焼を行う内燃機関の排気中のNO_xを効果的に除去可能な排気浄化装置に関する。

【0002】

【従来の技術】この種の排気浄化装置の例としては、例えば特開昭62-106826号公報に開示されたものがある。同公報の装置は、ディーゼル機関の排気通路に酸素の存在下でNO_xを吸収する吸収剤(触媒)を配置して排気中のNO_xを吸収させ、該吸収剤のNO_x吸収効率が低下したときに吸収剤への排気の流入を遮断して

吸収剤に気体状の還元剤を供給することにより、吸収剤からNO_xを放出させると共に放出されたNO_xを還元浄化するようにしたものである。

【0003】

【発明が解決しようとする課題】上記特開昭62-106826号公報の排気浄化装置では、NO_x吸収剤からのNO_xの放出と還元浄化（以下「再生」という）を行うために、水素等の気体状還元剤をNO_x吸収剤に供給している。しかし、水素等気体状の還元剤は貯蔵に際して特別な容器を必要とする等、取扱が困難な問題があり、特に車両用内燃機関に使用する場合には種々の問題を生じる。

【0004】従って、NO_x吸収剤の再生に用いる還元剤としては、取扱が簡単な液体の還元剤を使用することが好ましい。また、補給、貯蔵の煩雑さをなくすためには、できればガソリン、軽油等、当該車両の燃料をそのまま液体還元剤として使用することが望ましい。ところが、特に軽油等の液体燃料は沸点の異なる多くの成分を含んでおり、排気温度が低いと気化しにくい成分も含まれている。このため、これらの液体燃料をそのままNO_x吸収剤の上流側の排気通路に噴射した場合には、沸点の高い成分は気化せずに排気流とともに霧状のままNO_x吸収剤に到達してしまう場合がある。この場合NO_x吸収剤に到達した燃料は吸収剤表面に液状のまま付着し、吸収剤表面を覆う層を形成する。

【0005】NO_x吸収剤表面に付着した液体燃料は、吸収剤の温度がある程度高い場合には吸収剤の熱を受けて気化し、還元剤としての作用を行う。しかし、燃料が気化する際にNO_x吸収剤から気化熱相当の熱が奪われるため、NO_x吸収剤の温度が低下することになり、液状のまま到達する燃料の量が多いとNO_x吸収剤の温度が活性温度以下に低下してしまう場合がある。このため、軽油などの液体燃料を還元剤として使用すると、NO_x吸収剤の活性が低下してNO_x浄化率の低下を生じ、エミッションの悪化を招く問題が生じる恐れがある。

【0006】また、NO_x吸収剤の温度が燃料の気化温度よりも低下すると吸収剤に付着した燃料はもはや気化せずNO_x吸収剤の表面を覆ってしまい、有効表面積の減少によりNO_xの吸収、放出作用が阻害される、いわゆるNO_x吸収剤の低温被毒の問題が生じる場合がある。上記のため、従来は軽油等の液体燃料を還元剤として使用する場合には、排気通路にバーナ等を設けて液体燃料を不完全燃焼させ、発生するHC、CO等のガスを還元剤としてNO_x吸収剤に供給する必要があった。しかし、排気通路にバーナ等を設けて燃焼を行うことは安全上からも好ましくなく、また、バーナやその附帯設備を排気通路に設けるため、構造が複雑になる等の問題があった。

【0007】本発明は、上記の問題を解決し、軽油等の

液体燃料をNO_x吸収剤の還元剤として使用することのできる内燃機関の排気浄化装置を提供する事を目的としている。

【0008】

【課題を解決するための手段】本発明によれば、流入する排気ガスの空燃比がリーンであるときにNO_xを吸収し、流入する排気ガス中の酸素濃度を低下させると吸収したNO_xを放出するNO_x吸収剤を機関排気通路内に配置すると共に、機関運転中常時NO_x吸収剤に排気ガスを流通させておき、NO_x吸収剤に流入する排気ガスがリーンのときにNO_x吸収剤に吸収されたNO_xをNO_x吸収剤に流入する排気ガス中の酸素濃度が低下せしめられたときにNO_x吸収剤から放出するようにした内燃機関の排気浄化装置において、前記NO_x吸収剤に液体還元剤を供給してNO_x吸収剤に流入する排気ガス中の酸素濃度を低下せしめることによりNO_x吸収剤に吸収されているNO_xをNO_x吸収剤から放出させると共に、前記NO_x吸収剤に供給する液体還元剤を予熱する還元剤予熱手段を設けたことを特徴とする内燃機関の排気浄化装置が提供される。

【0009】

【作用】NO_x吸収剤上流側の排気通路に供給する液体燃料は供給前に予熱手段により予熱されて気化するため、液状のままNO_x吸収剤に到達する液体燃料が減少し、NO_x吸収剤の温度低下が防止される。このため、NO_x吸収剤の活性低下や低温被毒の問題が生じない。

【0010】

【実施例】以下、添付図面を用いて本発明の実施例を説明する。図1において、1はディーゼルエンジン、2はエンジンの吸気管、3はエンジンの排気管を示す。また、5は排気管3に接続された後述のNO_x吸収剤5である。本実施例では、エンジン排気管3のNO_x吸収剤5上流側には排気シャッターバルブ6が設けられている。

【0011】シャッターバルブ6は全開時の排気抵抗の少ないバタフライ弁の形式であり、エンジンの通常運転時には全開に保持されており、NO_x吸収剤5からのNO_xの再生操作時に所定開度まで閉弁され、排気管3を絞ってNO_x吸収剤5を通過する排気ガス量を低減させる。7はシャッターバルブ6を開閉駆動する負圧アクチュエータ等の適宜な形式のアクチュエータである。

【0012】また、エンジン排気管3のシャッターバルブ6とNO_x吸収剤5との間には後述する還元剤供給装置11が配置されており、NO_x吸収剤5の再生操作時にNO_x吸収剤の上流側の排気管に還元剤を供給するようになっている。図に20で示すのはエンジン1の電子制御ユニット(ECU)である。ECU20はCPU、RAM、ROM、及び入力ポート、出力ポートを相互に双方向バスで接続した構成の、公知のデジタルコンピュータからなり、エンジンの燃料噴射量制御等の基本制

御を行うほか、本実施例では排気シャッターバルブ6の開閉制御と、還元剤供給装置11からの還元剤供給制御を行っている。これらの制御のためECU20の入力ポートには、排気温度、エンジン回転数、アクセル開度等の信号がそれぞれ図示しないセンサから入力されている。

【0013】NO_x吸収剤5は例えばアルミニウム等の担体を使用し、この担体上に例えばカリウムK、ナトリウムNa、リチウムLi、セシウムCsのようなアルカリ金属、バリウムBa、カルシウムCaのようなアルカリ土類、ランタンLa、イットリウムYのような希土類から選ばれた少なくとも一つと、白金Ptのような貴金属とが担持されている。このNO_x吸収剤5は流入する排気の空燃比がリーンの場合にはNO_xを吸収し、酸素濃度が低下するとNO_xを放出するNO_xの吸放出作用を行う。

【0014】なお、上述の排気空燃比とは、ここではNO_x吸収剤5の上流側の排気通路やエンジン燃焼室、吸気通路等にそれぞれ供給された空気量の合計と燃料の合計の比を意味するものとする。従って、NO_x吸収剤5の上流側排気通路に燃料、還元剤または空気が供給されない場合には排気空燃比はエンジンの運転空燃比（エンジン燃焼室の燃焼における空燃比）と等しくなる。

【0015】本実施例では、ディーゼルエンジンが使用されているため、通常運転時の排気空燃比はリーンであり、NO_x吸収剤5は排気中のNO_xの吸収を行う。また、還元剤供給装置11から排気中に還元剤が導入されて酸素濃度が低下すると、NO_x吸収剤5は吸収した還元剤の放出を行う。この吸放出作用の詳細なメカニズムについては明らかでない部分もある。しかし、この吸放出作用は図7に示すようなメカニズムで行われているものと考えられる。次にこのメカニズムについて担体上に白金PtおよびバリウムBaを担持させた場合を例にとって説明するが他の貴金属、アルカリ金属、アルカリ土類、希土類を用いても同様なメカニズムとなる。

【0016】即ち、流入排気がかなりリーンになると流入排気中の酸素濃度が大巾に増大し、図7(A)に示されるようにこれら酸素O₂がO₂₋またはO²⁻の形で白金Ptの表面に付着する。一方、流入排気中のNOは白金Ptの表面上でこのO₂₋またはO²⁻と反応し、NO₂となる(2NO+O₂→2NO₂)。次いで生成されたNO₂の一部は白金Pt上で酸化されつつ吸収剤内に吸収されて酸化バリウムBaOと結合しながら、図7(A)に示されるように硝酸イオンNO₃⁻の形で吸収剤内に拡散する。このようにしてNO_xがNO_x吸収剤5内に吸収される。

【0017】従って、流入排気中の酸素濃度が高い限り白金Ptの表面でNO₂が生成され、吸収剤のNO_x吸収能力が飽和しない限りNO₂が吸収剤内に吸収されて硝酸イオンNO₃⁻が生成される。これに対して流入排

気中の酸素濃度が低下してNO₂の生成量が減少すると反応が逆方向(NO₃⁻→NO₂)に進み、こうして吸収剤内の硝酸イオンNO₃⁻がNO₂の形で吸収剤から放出される。すなわち、流入排気中の酸素濃度が低下するとNO_x吸収剤5からNO_xが放出されることになる。

【0018】一方、流入排気中にHC、CO等の還元成分が存在すると、これらの成分は白金Pt上の酸素O₂₋またはO²⁻と反応して酸化され、排気中の酸素を消費して排気中の酸素濃度を低下させる。また、排気中の酸素濃度低下によりNO_x吸収剤5から放出されたNO₂は図7(B)に示すようにHC、COと反応して還元される。このようにして白金Ptの表面上にNO₂が存在しなくなると吸収剤から次から次へとNO₂が放出される。

【0019】すなわち、流入排気中のHC、COは、まず白金Pt上のO₂₋またはO²⁻とただちに反応して酸化され、次いで白金Pt上のO₂₋またはO²⁻が消費されてもまだHC、COが残っていればこのHC、COによって吸収剤から放出されたNO_xおよび機関から排出されたNO_xが還元される。NO_x吸収剤5のNO_x放出、還元操作（再生操作）に使用する還元剤としては、排気中で炭化水素や一酸化炭素等の還元成分を発生するものであれば良く、水素、一酸化炭素等の気体、プロパン、プロピレン、ブタン等の液体又は気体の炭化水素、ガソリン、軽油、灯油等の液体燃料等が使用できるが、本実施例では前述のように貯蔵、補給等の際の煩雑さを避けるためディーゼルエンジン1の燃料である軽油を還元剤として使用している。

【0020】次に、図2を用いて本実施例の還元剤供給装置11について説明する。前述のように軽油を還元剤として使用する場合には軽油中の高沸点成分が液状のままNO_x吸収剤5に付着する問題が生じる。本実施例では以下に説明するように還元剤供給装置11から供給する軽油を予熱することにより上記の液体燃料の付着の問題を解決している。

【0021】図2において、還元剤供給装置11は、排気管3のNO_x吸収剤5上流側に配置された噴射弁12を備えている。噴射弁12は、前述のECU20からの制御信号に応じて開閉してNO_x吸収剤5上流側に還元剤（軽油）を噴射し、NO_x吸収剤5の再生操作を行う。軽油はディーゼルエンジン1の燃料供給装置14から、ECU20の制御信号に応じて開閉する遮断弁15と燃料通路13とを介して噴射弁12に圧力供給される。本実施例では、燃料通路13は排気管3の周囲に巻き回された熱交換部13aを備えており、排気管3内の排気ガスの熱により、熱交換部13a内の軽油を予熱するようになっている。

【0022】本実施例では、NO_x吸収剤5の再生操作が完了すると（すなわち、軽油の噴射を完了して噴射弁

12が閉弁すると）、ECU20の信号により遮断弁15が開弁する。これにより、噴射弁12までの燃料通路13内には燃料供給装置14の出口圧力相当の圧力の軽油が充填される。所定時間が経過すると遮断弁15は閉弁され、遮断弁15と噴射弁12との間の燃料通路13は両端を密閉された状態に保持される。

【0023】燃料通路13内に保持された軽油は、次回の再生操作が開始されるまでの間にこの密閉状態のまま熱交換部13aを介して排気ガスの熱を受け、加熱される。このため、燃料通路内13内の軽油は温度が上昇するとともに、蒸気圧の上昇により圧力が上昇し、高温、高圧の状態になる。次いで、NO_x吸収剤5の再生条件が成立するとECU20の信号により噴射弁12が開弁する。これにより、燃料通路13内の高圧の軽油は噴射弁12から排気通路3内に噴射される。軽油は燃料通路13内で高温になり低沸点成分は既に気化しているが、液状のまま残っていた高沸点成分も、燃料通路13内が噴射弁12の開弁により高圧状態から急激に減圧されるため瞬時に気化する。このため、NO_x吸収剤5には気体状の軽油のみが供給され、軽油の液状成分の到達による前述の問題が防止される。

【0024】なお、上述の実施例では、燃料供給装置14と燃料通路13との間にECU20の信号に応じて開閉する遮断弁15を設けているが、遮断弁15の代わりに燃料通路13から燃料供給装置14への軽油の逆流を防止する逆止弁を設けた構成としてもよい。この場合には、再生操作時に噴射弁12が開弁して燃料通路13内の圧力が燃料供給圧力以下に低下すると逆止弁を通って燃料供給装置14から燃料通路13内に自動的に軽油が流入するため、遮断弁15の開閉操作が不要となる。

【0025】なお、本実施例ではNO_x吸収剤5への軽油供給量は遮断弁15と噴射弁12との間の燃料通路13の容積と、燃料供給装置14の燃料供給圧力により決定される。また、本実施例では燃料通路13の熱交換部13aは排気管3の周囲に設けられているが、図3に示すように熱交換部13aを排気管3内に配置した構成とすれば軽油を更に高温高圧の状態に保持することができる。

【0026】次に、図4に本発明の別の実施例を示す。本実施例では、燃料通路13の熱交換部13aは、排気管3の周囲に形成された比較的容量の大きな容器の形式とされている。また、熱交換部13aの下部には遮断弁16を介して燃料回収通路17が接続されており、噴射弁12は熱交換部13aの上部に接続されている。本実施例では、熱交換部13a内の軽油が加熱され高温高圧状態になると、軽油の気化した低沸点成分は熱交換部13aの上部にに充満し、下部には気化しない高沸点成分が液体のまま滞留する。噴射弁12が開弁すると、熱交換部13内の軽油が排気管3内に噴射されるが、噴射弁12は熱交換部13aの上部に接続されているため噴射

弁12からは上部の気化した低沸点成分と、熱交換部13内の減圧により気化した高沸点成分のみが噴射される。このため、噴射弁12からは気体状の軽油のみが噴射されるのでNO_x吸収剤5への液状成分の付着をより確実に防止できる。

【0027】なお、本実施例では再生操作完了後熱交換部13a下部の遮断弁16が開弁され、熱交換部13a内に液体のまま残留している高沸点成分が回収通路17を介してエンジン燃料系統に回収されるとともに、上部の遮断弁15が下部遮断弁16の開弁と同時に開き、燃料供給装置14から熱交換部13aに軽油が供給されて熱交換部13a内の軽油の入替えが行われる。上部の遮断弁15は下部の遮断弁16が閉弁した後所定時間経過後に閉弁し、その間に熱交換部13aに所定量の新しい軽油が充填される。

【0028】次に図5に本発明の更に別の実施例を示す。本実施例では、還元剤供給装置11には前述の実施例のような熱交換部は設けられておらず、噴射弁12下流側の排気通路3に気化用蓄熱体18aを内蔵した予熱室18が設けられている点が相違している。蓄熱体18aはセラミック焼結材等の多孔質材料から構成され、図6に示すように内部に排気流方向の通路19が形成されている。通路19は、下流側端部が閉塞された通路19aと上流側端部が閉塞された通路19bとが交互に配置されており、排気は通路19aから蓄熱体18aに流入し、通路19a、19bとを隔てる壁面19cを通過して通路19bから流出するようになっている。

【0029】本実施例では、蓄熱体18aはNO_x吸収剤5がNO_xの吸収を行っている時に通過する排気ガスにより加熱され高温になる。NO_x吸収剤5の再生操作時には、噴射弁12から噴射された霧状の軽油は排気とともに蓄熱体18aに流入する。この際、軽油の高沸点成分は液状のまま蓄熱体18aに流入するが、排気が蓄熱体18aの通路19aと19bとを隔てる壁面19cを通過する際にトラップされるため、蓄熱体18aの下流側のNO_x吸収剤5には排気と、軽油の気化成分のみが到達する。また、蓄熱体18aにトラップされた軽油の高沸点成分は高温の蓄熱体18aから気化熱を奪って気化するため、高沸点成分の気化に際してNO_x吸収剤5の温度が低下することがない。また、排気温度が低い場合は、蓄熱体18aにトラップされた軽油の高沸点成分の一部は液状のまま蓄熱体18aに残留することになるが、エンジンの負荷が増大して排気温度が上昇したときに気化して蓄熱体18aから流出し、NO_x吸収剤5の触媒作用により酸化されるため蓄熱体18aの排気通路が閉塞したり、HC、CO等のエミッションが悪化することはない。本実施例では、予熱室18の外部には断熱材18bが設けられ、蓄熱体18aからの熱放散を防止し、蓄熱体18aの高温を維持するようになっている。

【0030】なお、上記に説明した実施例では、排気温度が比較的低い場合には軽油の高沸点成分の一部が液状のままNO_x吸収剤5に到達する場合が考えられるが、上述のように到達する液体成分の量は僅かであり、また、液体成分に先立って到達した気化成分の酸化反応による発熱によりNO_x吸収剤5の温度が上昇しているためNO_x吸収剤5に到達した液体成分も速やかに気化し、NO_x吸収剤5の活性低下や低温被毒を生じるには至らない。

【0031】

【発明の効果】本発明によれば、液体還元剤を用いてNO_x吸収剤の再生を行う場合に、NO_x吸収剤に供給する前に液体還元剤を予熱する手段を設けたことにより、NO_x吸収剤に液状のまま還元剤が到達することによるNO_x吸収剤の活性低下や低温被毒の発生を防止し、液体還元剤を用いて簡易な手段でNO_x吸収剤の再生操作を行うことができる。

【図面の簡単な説明】

【図1】本発明の排気浄化装置の第一の実施例を示す図である。

【図2】図1の還元剤供給装置の構成の一例を示す図である。

【図3】図1の還元剤供給装置の構成の一例を示す図である。

【図4】図1の還元剤供給装置の構成の一例を示す図である。

ある。

【図5】本発明の排気浄化装置の第二の実施例を示す図である。

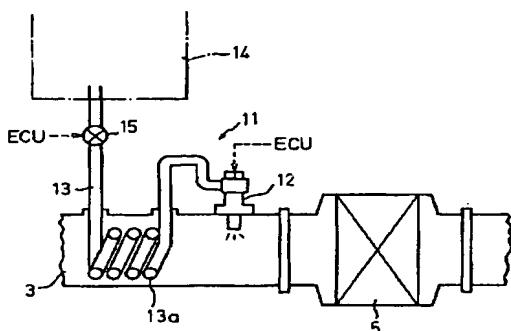
【図6】図5の蓄熱体の構成を示す図である。

【図7】NO_x吸収剤のNO_x吸放出作用を説明する図である。

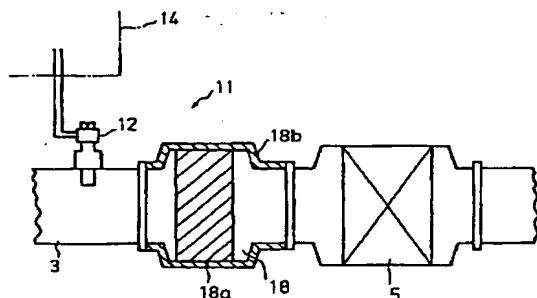
【符号の説明】

- 1 …ディーゼルエンジン
- 2 …吸気管
- 3 …排気管
- 5 …NO_x吸収剤
- 6 …シャッターバルブ
- 7 …アクチュエータ
- 11 …還元剤供給装置
- 12 …噴射弁
- 13 …燃料通路
- 13a …熱交換部
- 14 …燃料供給装置
- 15 …遮断弁
- 16 …遮断弁
- 17 …回収通路
- 18 …予熱室
- 18a …蓄熱体
- 19 …排気通路
- 20 …ECU

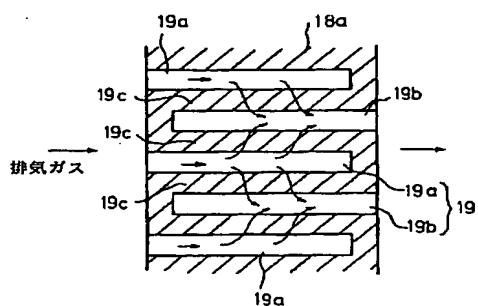
【図3】



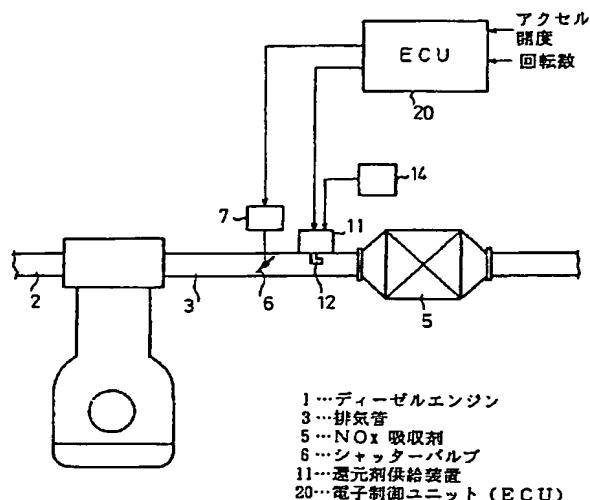
【図5】



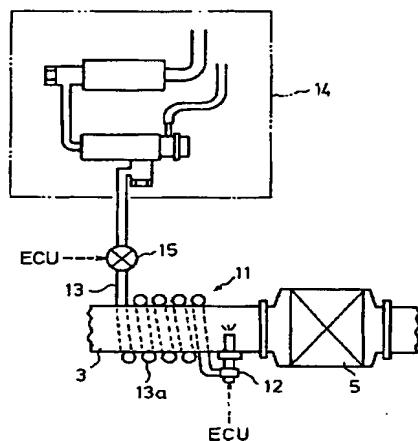
【図6】



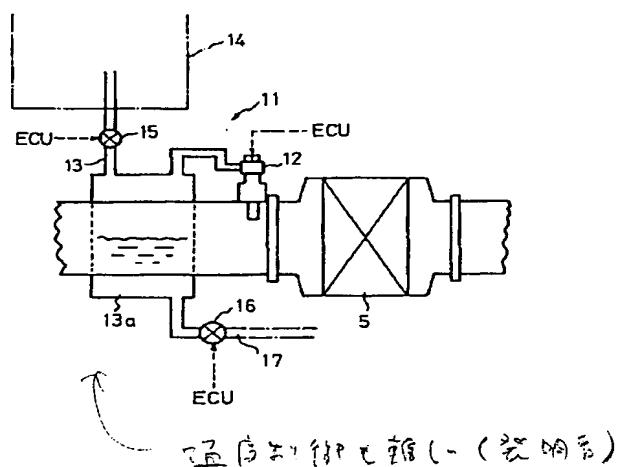
【図1】



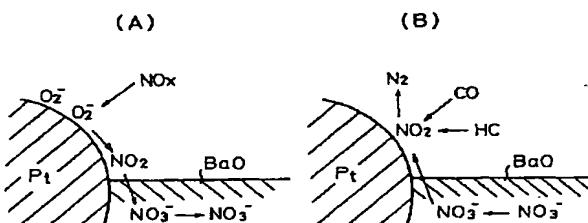
【図2】



【図4】



【図7】



フロントページの続き

(56) 参考文献 特開 昭62-106826 (JP, A)
 実開 平4-54926 (JP, U)
 特許2600492 (JP, B2)

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CLAIMS

(57) [Claim(s)]

[Claim 1] It is NOX when the air-fuel ratio of the flowing exhaust gas is Lean. NOX absorbed when it absorbs and the oxygen density in the flowing exhaust gas was reduced NOX to emit While arranging an absorbent in an engine flueway It is always NOX during engine operation. Exhaust gas is circulated to an absorbent. NOX It is NOX when the exhaust gas which flows into an absorbent is Lean. NOX absorbed by the absorbent NOX It is NOX when the oxygen density in the exhaust gas which flows into an absorbent is made to fall. In an internal combustion engine's exhaust emission control device it was made to emit from an absorbent Said NOX A liquid reducing agent is supplied to an absorbent and it is NOX. It is NOX by making the oxygen density in the exhaust gas which flows into an absorbent fall. NOX absorbed by the absorbent NOX While making it emit from an absorbent Said NOX Exhaust emission control device of the internal combustion engine characterized by establishing a reducing-agent preheating means to heat beforehand the liquid reducing agent supplied to an absorbent.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Industrial Application] This invention is NOX under exhaust air of internal combustion engines which burn the Lean air-fuel ratio in most operating range, such as a gasoline engine which carries out a diesel power plant and lean combustion to a detail, about an internal combustion engine's exhaust emission control device. It is effectively related with a removable exhaust emission control device.

[0002]

[Description of the Prior Art] As an example of this kind of exhaust emission control device, there are some which were indicated by the Provisional-Publication-No. 62-No. 106826 official report, for example. The equipment of this official report is NOX under existence of oxygen to a Diesel engine's flueway. The absorbent (catalyst) to absorb is arranged and it is NOX under exhaust air. It is made to absorb and is NOX of this absorbent. By intercepting the inflow of the exhaust air to an absorbent and supplying a gas-like reducing agent to an absorbent, when absorption efficiency falls, it is an absorbent to NOX. While making it emit, it is made to carry out reduction clarification of the emitted NOX.

[0003]

[Problem(s) to be Solved by the Invention] With the exhaust emission control device of the above-mentioned Provisional-Publication-No. 62-No. 106826 official report, it is NOX. NOX from an absorbent In order to perform bleedoff and reduction clarification (henceforth "playback"), it is NOX about gas-like reducing agents, such as hydrogen. The absorbent is supplied. However, a gas [, such as hydrogen,]-like reducing agent produces various problems, when there is a problem with difficult handling, such as needing a special container on the occasion of storage, and it uses it especially for the internal combustion engine for cars.

[0004] Therefore, NOX It is desirable that handling uses the reducing agent of an easy liquid as a reducing agent used for playback of an absorbent. Moreover, in order to lose the complicatedness of makeup and storage, if it can do, it is desirable [a gasoline gas oil, etc.] to use the fuel of the car concerned as a liquid reducing agent as it is. However, especially liquid fuel, such as gas oil, contains many components from which the boiling point differs, and the component which will be hard to evaporate if an exhaust-gas temperature is low is also contained. For this reason, it is NOX as it is about such liquid fuel. The component with the boiling point high when it injects to the flueway of the upstream of an absorbent is NOX in an exhaust stream with the shape of a fog, without evaporating. An absorbent may be reached. In this case, NOX The fuel which reached the absorbent adheres, while it has been liquefied on the absorbent front face, and it forms a wrap layer for an absorbent front face.

[0005] NOX The liquid fuel adhering to an absorbent front face is evaporated in response to the heat of an absorbent, when the temperature of an absorbent is to some extent high, and it performs the operation as a reducing agent. However, it is NOX in case a fuel evaporates. Since the heat of heat of vaporization is taken from an absorbent, it is NOX. It is NOX if there are many amounts of the fuel which the temperature of an absorbent will fall, and reaches while it has been liquefied. The temperature of an absorbent may fall and carry out to below activity temperature. For this reason, it is NOX if liquid fuel, such as gas oil, is used as a reducing agent. The activity of an absorbent falls

and it is NOX. There is a possibility that decline in the rate of clarification may be produced and the problem which causes aggravation of emission may arise.

[0006] Moreover, NOX It does not evaporate any longer but the fuel which adhered to the absorbent when the temperature of an absorbent fell rather than the evaporation temperature of a fuel is NOX. The front face of an absorbent is covered and it is NOX by reduction of effective surface area. The so-called NOX from which absorption and a bleedoff operation are prevented The problem of low-temperature poisoning of an absorbent may arise. It is NOX, using [in using liquid fuel, such as gas oil, as a reducing agent conventionally for the above form a burner etc. in a flueway, carry out the incomplete combustion of the liquid fuel, and] the occurring gas, such as HC and CO, as a reducing agent. The absorbent needed to be supplied. However, it was not desirable from insurance to have burned by forming a burner etc. in a flueway, and in order to form a burner and its incidental facility in a flueway, it had problems, like structure becomes complicated.

[0007] This invention solves the above-mentioned problem and is NOX about liquid fuel, such as gas oil. It aims at offering an internal combustion engine's exhaust emission control device which can be used as a reducing agent of an absorbent.

[0008]

[Means for Solving the Problem] It is NOX when the air-fuel ratio of the flowing exhaust gas is Lean according to this invention. NOX absorbed when it absorbs and the oxygen density in the flowing exhaust gas was reduced NOX to emit While arranging an absorbent in an engine flueway It is always NOX during engine operation. Exhaust gas is circulated to an absorbent. NOX It is NOX when the exhaust gas which flows into an absorbent is Lean. NOX absorbed by the absorbent NOX It is NOX when the oxygen density in the exhaust gas which flows into an absorbent is made to fall. In an internal combustion engine's exhaust emission control device it was made to emit from an absorbent Said NOX A liquid reducing agent is supplied to an absorbent and it is NOX. It is NOX by making the oxygen density in the exhaust gas which flows into an absorbent fall. NOX absorbed by the absorbent NOX While making it emit from an absorbent Said NOX The exhaust emission control device of the internal combustion engine characterized by establishing a reducing-agent preheating means to heat beforehand the liquid reducing agent supplied to an absorbent is offered.

[0009]

[Function] NOX In order for a preheating means to preheat before supply and to evaporate, the liquid fuel supplied to the flueway of the absorbent upstream is NOX while it is liquefied. The liquid fuel which reaches an absorbent decreases in number, and it is NOX. Temperature lowering of an absorbent is prevented. For this reason, NOX The problem of activity lowering of an absorbent or low-temperature poisoning does not arise.

[0010]

[Example] Hereafter, the example of this invention is explained using an accompanying drawing. In drawing 1, in 1, a diesel power plant and 2 show an engine inlet pipe, and 3 shows an engine exhaust pipe. Moreover, 5 is the below-mentioned NOX connected to the exhaust pipe 3. It is an absorbent 5. At this example, it is NOX of the engine exhaust pipe 3. The exhaust shutter bulb 6 is formed in the absorbent 5 upstream.

[0011] It is the format of a butterfly valve with few exhaust back pressures at the time of full admission, and is held at full admission at the time of usual operation of an engine, and the shutter bulb 6 is NOX. Clausilium is carried out to a predetermined opening at the time of playback actuation of NOX from an absorbent 5, an exhaust pipe 3 is extracted, and it is NOX. The amount of exhaust gas which passes an absorbent 5 is reduced. 7 is the actuator of proper formats, such as a negative pressure actuator which carries out closing motion actuation of the shutter bulb 6.

[0012] Moreover, the shutter bulb 6 and NOX of the engine exhaust pipe 3 Between absorbents 5, the reducing-agent feeder 11 mentioned later is arranged, and it is NOX. It is NOX at the time of playback actuation of an absorbent 5. A reducing agent is supplied to the exhaust pipe of the upstream of an absorbent. It is the electronic control unit (ECU) of an engine 1 which is shown in drawing by 20. ECU20 consists of a well-known digital computer of a configuration of having connected CPU, RAM, ROM and input port, and an output port mutually with the bi-directional bus, and performs basic control, such as fuel-oil-consumption control of an engine, and also it is performing closing motion control of the exhaust shutter bulb 6 and reducing-agent supply control

from the reducing-agent feeder 11 in this example. Signals, such as an exhaust-gas temperature, an engine speed, and an accelerator opening, are inputted into the input port of ECU20 from the sensor which is not illustrated, respectively for these control.

[0013] NOX An absorbent 5 uses support, such as an alumina, and is Potassium K, Sodium Na, Lithium Li, and Caesium Cs on this support. Alkali metal [like] and barium Ba, Calcium calcium At least one chosen from an alkaline earth [like], Lanthanum La, and rare earth like Yttrium Y, and platinum Pt Noble metals [like] are supported. This NOX An absorbent 5 is NOX when the air-fuel ratio of the flowing exhaust air is Lean. It is NOX, if it absorbs and an oxygen density falls. NOX to emit An absorption/emission action is performed.

[0014] In addition, an above-mentioned exhaust air air-fuel ratio is NOX here. The ratio of the sum total of an air content and the sum total of a fuel supplied to the flueway of the upstream of an absorbent 5, an engine combustion chamber, an inhalation-of-air path, etc., respectively shall be meant. Therefore, NOX When a fuel, a reducing agent, or air is not supplied to the upstream flueway of an absorbent 5, an exhaust air air-fuel ratio becomes equal to an engine operation air-fuel ratio (air-fuel ratio in combustion of an engine combustion chamber).

[0015] Since the diesel power plant is used in this example, the exhaust air air-fuel ratio at the time of operation is usually Lean, and it is NOX. An absorbent 5 is NOX under exhaust air. It absorbs. Moreover, it is NOX, if a reducing agent is introduced during exhaust air from the reducing-agent feeder 11 and an oxygen density falls. An absorbent 5 emits the absorbed reducing agent. There is also a part which is not clear about the detailed mechanism of this absorption/emission action. However, it is thought that this absorption/emission action is performed by the mechanism as shown in drawing 7. Next, it is Platinum Pt on support about this mechanism. And barium Ba It becomes the same mechanism even if it uses other noble metals, alkali metal, an alkaline earth, and rare earth, although explained taking the case of the case where it is made to support.

[0016] That is, if inflow exhaust air becomes Lean considerably, the oxygen density under inflow exhaust air will increase sharply, and it is drawing 7 (A). It is these oxygen O₂ so that it may be shown. O₂ - Or it adheres to the front face of Platinum Pt in the form of O₂⁻, on the other hand -- NO under inflow exhaust air -- platinum Pt a front-face top -- this O₂⁻ or O₂⁻ reacting -- NO₂ It becomes (2 NO+O₂ → 2NO₂). Subsequently, generated NO₂ A part is drawing 7 (A), being absorbed in an absorbent and combining with the barium oxide BaO oxidizing on Platinum Pt. It is nitrate ion NO₃⁻ so that it may be shown. - It is spread in an absorbent in a form. Thus, NOX NOX It is absorbed in an absorbent 5.

[0017] Therefore, it is Platinum Pt as long as the oxygen density under inflow exhaust air is high. It is NO₂ in a front face. It is generated and is NOX of an absorbent. It is NO₂ unless absorptance is saturated. It is absorbed in an absorbent and is nitrate ion NO₃⁻. - It is generated. On the other hand, the oxygen density under inflow exhaust air falls, and it is NO₂. When the amount of generation decreases, a reaction goes to hard flow (NO₃→NO₂), and it is the nitrate ion NO₃⁻ in an absorbent in this way. - NO₂ It is emitted from an absorbent in a form. That is, it is NOX if the oxygen density under inflow exhaust air falls. An absorbent 5 to NOX It will be emitted.

[0018] On the other hand, these components are Platinum Pt if reduction components, such as HC and CO, exist during inflow exhaust air. Upper oxygen O₂ - Or it reacts with O₂⁻, and oxidizes, the oxygen under exhaust air is consumed, and the oxygen density under exhaust air is reduced. Moreover, it is NOX by the oxygen density lowering under exhaust air. NO₂ emitted from the absorbent 5 Drawing 7 (B) It reacts with HC and CO and is returned so that it may be shown. Thus, platinum Pt It is NO₂ on a front face. When it stops existing, it is NO₂ from an absorbent to the degree from a degree. It is emitted.

[0019] namely, HC under inflow exhaust air and CO -- first -- platinum Pt Upper O₂⁻ or it reacts immediately with O₂⁻ and oxidizes -- having -- subsequently -- platinum Pt Upper O₂⁻ Or NOX emitted by this HC and CO from the absorbent when HC and CO still remained, even if O₂⁻ was consumed And NOX discharged by the engine It is returned. NOX NOX of an absorbent 5 As a reducing agent used for bleedoff and reduction actuation (playback actuation) That what is necessary is just what is exhausting and generates reduction components, such as a hydrocarbon and a carbon monoxide, although liquid fuel, such as a hydrocarbon of liquids, such as gases, such as hydrogen and a carbon monoxide, a propane, a propylene, and butane, or a gas, a gasoline, gas oil, and

kerosene, etc. can be used In this example, in order to avoid the complicatedness in the cases, such as storage and makeup, as mentioned above, the gas oil which is the fuel of a diesel power plant 1 is used as a reducing agent.

[0020] Next, the reducing-agent feeder 11 of this example is explained using drawing 2 . It is NOX while the high-boiling point component in gas oil is liquefied, when using gas oil as a reducing agent as mentioned above. The problem adhering to an absorbent 5 arises. In this example, the problem of adhesion of the above-mentioned liquid fuel is solved by heating beforehand the gas oil supplied from the reducing-agent feeder 11 so that it may explain below.

[0021] Setting to drawing 2 , the reducing-agent feeder 11 is NOX of an exhaust pipe 3. It has the injection valve 12 arranged at the absorbent 5 upstream. Opening and closing according to the control signal from above-mentioned ECU20, an injection valve 12 is NOX. A reducing agent (gas oil) is injected to the absorbent 5 upstream, and playback actuation of the NOX absorbent 5 is performed. Pressure supply of the gas oil is carried out from the fuel supply system 14 of a diesel power plant 1 at an injection valve 12 through the isolation valve 15 and the fuel path 13 which are opened and closed according to the control signal of ECU20. In this example, the fuel path 13 is equipped with heat exchange section 13a wound around the perimeter of an exhaust pipe 3 about, and heats beforehand the gas oil in heat exchange section 13a with the heat of the exhaust gas in an exhaust pipe 3.

[0022] this example -- NOX If playback actuation of an absorbent 5 is completed, injection of gas oil is completed and an injection valve 12 closes the valve namely,, an isolation valve 15 will open with the signal of ECU20. Thereby, it fills up with the gas oil of the pressure of an outlet pressure of a fuel supply system 14 in the fuel path 13 to an injection valve 12. If predetermined time passes, clausilium of the isolation valve 15 will be carried out, and the fuel path 13 between an isolation valve 15 and an injection valve 12 will be held at the condition that ends were sealed.

[0023] With this sealing condition, through heat exchange section 13a, the gas oil held in the fuel path 13 receives the heat of exhaust gas, and is heated until next playback actuation is started. For this reason, a pressure rises by lifting of vapor pressure and the gas oil in 13 in a fuel path will be in an elevated temperature and a high-pressure condition while temperature rises. Subsequently, NOX If the playback conditions of an absorbent 5 are satisfied, an injection valve 12 will open with the signal of ECU20. Thereby, the high-pressure gas oil in the fuel path 13 is injected in a flueway 3 from an injection valve 12. Although gas oil became an elevated temperature in the fuel path 13 and the low-boiling point component is already evaporated, since the inside of the fuel path 13 is rapidly decompressed by valve opening of an injection valve 12 from a high voltage condition, the high-boiling point component which remained while it had been liquefied is also evaporated in an instant. For this reason, NOX Only gas-like gas oil is supplied to an absorbent 5, and the above-mentioned problem by attainment of the liquefied component of gas oil is prevented.

[0024] In addition, although the isolation valve 15 opened and closed according to the signal of ECU20 is formed between the fuel supply system 14 and the fuel path 13 in the above-mentioned example, it is good also as a configuration which prepared the check valve which prevents the back run of the gas oil from the fuel path 13 to a fuel supply system 14 instead of an isolation valve 15. In this case, since gas oil will flow automatically in the fuel path 13 from a fuel supply system 14 through a check valve if an injection valve 12 opens at the time of playback actuation and the pressure in the fuel path 13 falls below to a fuel-supply pressure, the switching operation of an isolation valve 15 becomes unnecessary.

[0025] In addition, at this example, it is NOX. The gas oil amount of supply to an absorbent 5 is determined by the volume of the fuel path 13 between an isolation valve 15 and an injection valve 12, and the fuel-supply pressure of a fuel supply system 14. Moreover, in this example, although heat exchange section 13a of the fuel path 13 is prepared in the perimeter of an exhaust pipe 3, it can hold the configuration, then gas oil which have arranged heat exchange section 13a in an exhaust pipe 3 as shown in drawing 3 in the condition of further elevated-temperature high voltage.
 [0026]

Next, another example of this invention is shown in drawing 4 . In this example, heat exchange section 13a of the fuel path 13 is made into the format of the container with a comparatively big capacity formed in the perimeter of an exhaust pipe 3. Moreover, the fuel recovery path 17 is connected to the lower part of heat exchange section 13a through the isolation valve 16, and the

injection valve 12 is connected to the upper part of heat exchange section 13a. in this example, if the gas oil in heat exchange section 13a is heated and it will be in an elevated-temperature high voltage condition, it is [upper part / of heat exchange section 13a] alike and full of the low-boiling point component which gas oil evaporated, and while the high-boiling point component which is not evaporated has been a liquid, it will pile up in the lower part. If an injection valve 12 opens, the gas oil in the heat exchange section 13 will be injected in an exhaust pipe 3, but since the injection valve 12 is connected to the upper part of heat exchange section 13a, from an injection valve 12, only the low-boiling point component which the upper part evaporated, and the high-boiling point component evaporated with the reduced pressure in the heat exchange section 13 are injected. For this reason, since only gas-like gas oil is injected from an injection valve 12, it is NOX. Adhesion of a liquefied component in an absorbent 5 can be prevented more certainly.

[0027] In addition, in this example, the isolation valve 16 of the completion post heating exchange section of playback actuation 13a lower part be open, while the high-boiling point components which remain in heat exchange section 13a with a liquid be collect by the engine fuel system through the recovery path 17, the upside isolation valve 15 be supply to valve opening and coincidence of the lower isolation valve 16, gas oil be supply to heat exchange section 13a from an aperture and a fuel supply system 14, and exchange of the gas oil in heat exchange section 13a be perform. After the lower isolation valve 16 closes the upside isolation valve 15, it is closed after predetermined time progress, and heat exchange section 13a is filled up with the new gas oil of the specified quantity between them.

[0028] Next, still more nearly another example of this invention is shown in drawing 5. In this example, the point that the heat exchange section like [the reducing-agent feeder 11] the above-mentioned example is not prepared, but the preheating room 18 which built heat-regenerative element 18a for evaporation in the flueway 3 of the injection valve 12 downstream is formed is different. Heat-regenerative element 18a consists of porous materials, such as ceramic sintering material, and as shown in drawing 6 $R > 6$, the path 19 of an exhaust air flow direction is formed in the interior. Path 19a by which the downstream edge was blockaded, and path 19b by which the upstream edge was blockaded are arranged by turns, and exhaust air flows into heat-regenerative element 18a from path 19a, and a path 19 passes wall surface 19c which separates Paths 19a and 19b, and flows out of path 19b.

[0029] At this example, heat-regenerative element 18a is NOX. An absorbent 5 is NOX. While absorbing, it is heated by the exhaust gas to pass and becomes an elevated temperature. NOX The gas oil of the shape of a fog injected from the injection valve 12 at the time of playback actuation of an absorbent 5 flows into heat-regenerative element 18a with exhaust air. Under the present circumstances, since it flows into heat-regenerative element 18a while it has been liquefied, but a trap is carried out in case exhaust air passes wall surface 19c which separates the paths 19a and 19b of heat-regenerative element 18a, the high-boiling point component of gas oil is NOX of the downstream of heat-regenerative element 18a. Only exhaust air and the evaporation component of gas oil reach an absorbent 5. Moreover, in order to take and evaporate heat of vaporization from hot heat-regenerative element 18a, evaporation of a high-boiling point component is faced, and the high-boiling point component of the gas oil by which the trap was carried out to heat-regenerative element 18a is NOX. The temperature of an absorbent 5 does not fall. Moreover, although it will remain to heat-regenerative element 18a while a part of high-boiling point component of the gas oil by which the trap was carried out to heat-regenerative element 18a has been liquefied when an exhaust-gas temperature is low It evaporates, when an engine load increases and an exhaust-gas temperature rises, and it flows out of heat-regenerative element 18a, and is NOX. In order to oxidize by the catalysis of an absorbent 5, the flueway of heat-regenerative element 18a does not blockade, or emission, such as HC and CO, does not get worse. In this example, heat insulator 18b is prepared in the exterior of the preheating room 18, the heat leakage from heat-regenerative element 18a is prevented, and the elevated temperature of heat-regenerative element 18a is maintained.

[0030] In addition, at the example explained above, when an exhaust-gas temperature is comparatively low, while a part of high-boiling point component of gas oil is liquefied, it is NOX. Although the case where an absorbent 5 is reached can be considered The amount of the liquid component which reaches as mentioned above is NOX by generation of heat by oxidation reaction of

the evaporation component which are few and reached in advance of the liquid component. Since the temperature of an absorbent 5 is rising, it is NOX. The liquid component which reached the absorbent 5 is also evaporated promptly. NOX It does not come to produce activity lowering or low-temperature poisoning of an absorbent 5.

[0031]

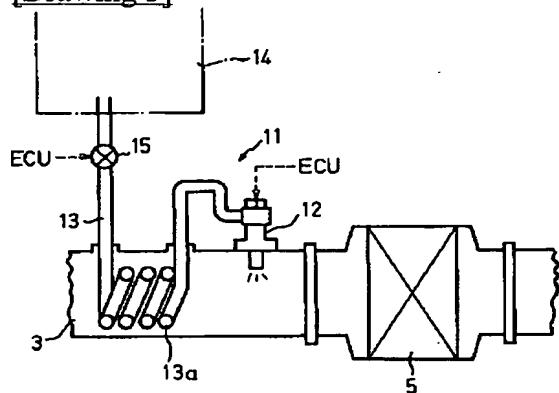
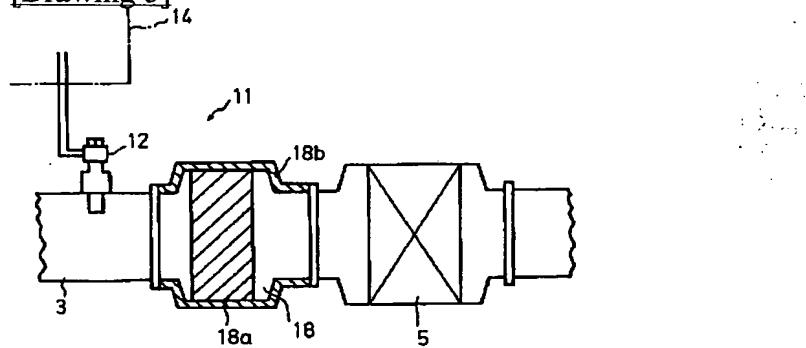
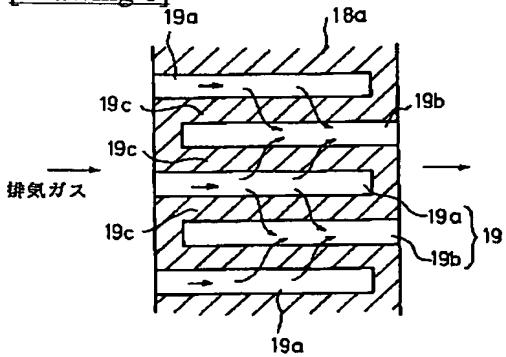
[Effect of the Invention] According to this invention, a liquid reducing agent is used, and it is NOX. It is NOX when reproducing an absorbent. NOX by a reducing agent reaching by having established a means to heat a liquid reducing agent beforehand before supplying an absorbent, while it has been liquefied to the NOX absorbent Activity lowering of an absorbent and generating of low-temperature poisoning are prevented, a liquid reducing agent is used, and it is NOX with a simple means. Playback actuation of an absorbent can be performed.

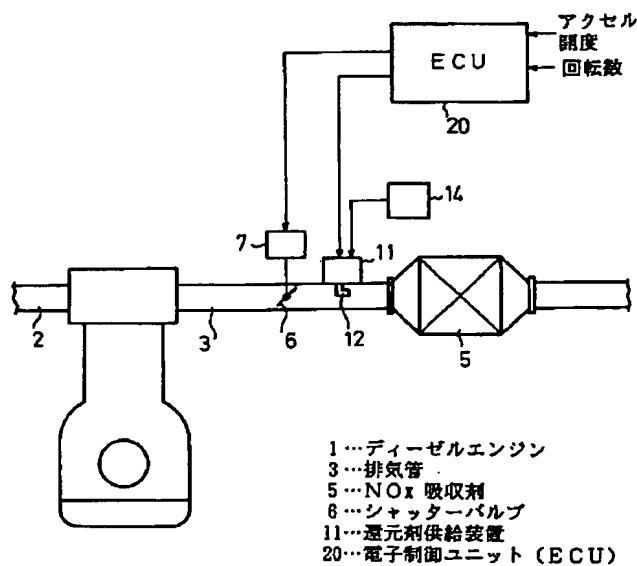
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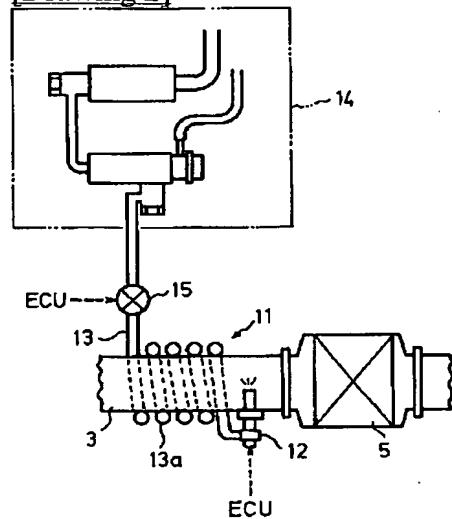
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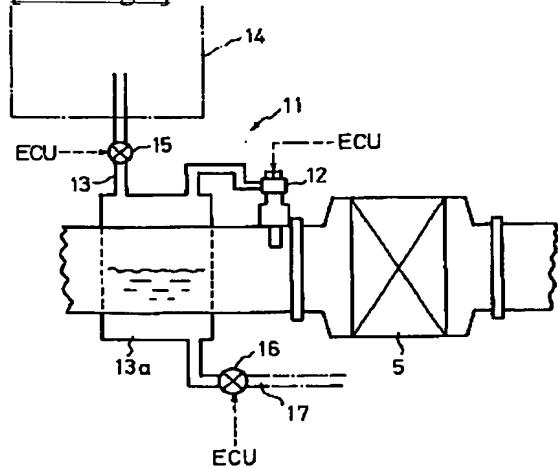
DRAWINGS**[Drawing 3]****[Drawing 5]****[Drawing 6]****[Drawing 1]**



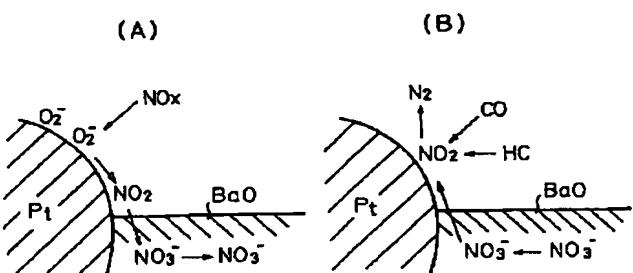
[Drawing 2]



[Drawing 4]



[Drawing 7]



[Translation done.]